by interested me more; for they, observant of my approach, stood holding the oars of their rude skiff, eager to earn "dos reales" by transferring me to the opposite bank. I was not unwilling to avail myself of their services. Once on the Arizona side of the river, an hour's walk would bring me to the thriving little town of Yuma, and my five days on the desert had well prepared me to appreciate the comforts of a well kept village hotel and the society of the civilized.

——:o:——

THE METHOD OF DISTINGUISHING SPECIES OF POPULUS AND JUGLANS BY THE YOUNG NAKED BRANCHES.[1]

BY PROF. W. J. BEAL.

IT is supposed to be the aim of the botanist when he describes a plant to name the peculiarities which are the most striking and constant, especially those which are easily seen with the unassisted eye. The writer has often been surprised that the peculiarities of the pith, bark, leaf scars and buds of our deciduous leaved trees and shrubs are not more frequently given in descriptions.

For five or six months of each year most of these plants are destitute of flowers, fruit or leaves. If it is easy or possible to distinguish species by the points above named, it certainly would often be very convenient. In 1876, Frederick Brendel, of Peoria, Illinois, said:[2] "We have no surer guide than the characters taken from the arrangement, form and construction of the buds, and in many cases from the leaf scars."

I will now proceed to point out some of the differences between the species of Populus and of Juglans, as seen when the young growth is destitute of foliage. I have studied four species of Populus and two of Juglans, all natives of Michigan.

Populus tremuloides.—In very slender branches one year old all of the pith is green; in larger branches a green layer surrounds the pith, which is of a whitish color much resembling the wood. With a short exposure to the air the pith becomes brown.

The bud scales are polished. The transverse diameter of the

[1] Read at the Boston meeting of the American Association for the Advancement of Science, Aug., 1880.

[2] Bulletin of the Illinois Museum of Natural History, No. 1, page 26.

leaf scar slightly exceeds the vertical diameter. Fig. 1, *a b c*, illustrates the buds and bud scars of *P. tremuloides*. The buds are not viscid. The one lettered *a* is a drawing of a portion of a

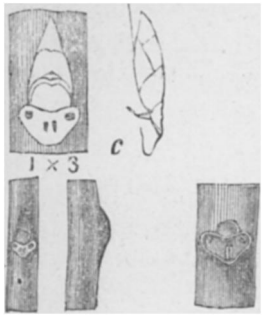

FIG. 1.

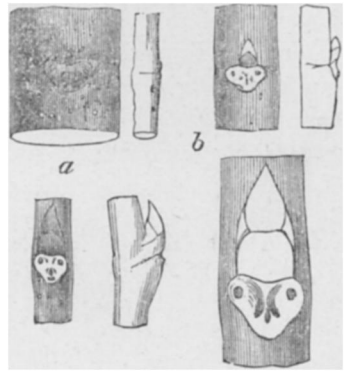

FIG. 2.

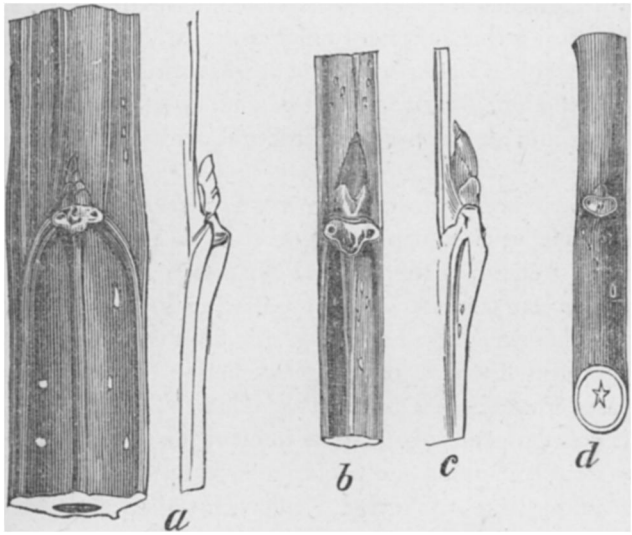

FIG. 3.

EXPLANATION OF THE FIGURES.

FIG. 1.—*Populus tremuloides*. *a*, scar and bud near base of branch, enlarged three diameters; *b*, natural size near the middle of a rapid growth; *c*, front and side view of same enlarged three diameters.

FIG. 2.—*Populus grandidentata*. *a*, enlarged front and side view of bud and scar near the base of a year's growth; *b*, the same farther up the stem; *c*, enlarged view near the middle of stem.

FIG. 3.—*Populus monilifera*. *a*, natural size figure near the middle of a large thrifty growth; *b c*, views of middle of slender growth; *d*, view near the base of stem.

stem not far from the base of the growth of last year; the others are taken from near the middle of the same growth. These illustrations and the succeeding ones are all drawn to the same scale, unless otherwise designated.

Populus grandidentata.—In thrifty twigs, one year old, the pith is yellowish white; the wood greenish white. The pith in twigs two or three years old is light brown. The buds are slightly pubescent under a lens and of a grayish-brown color, not viscid. Near the middle of a branch, the leaf scars are about as broad as long. Near the base the transverse diameter is the greater. The internodes of this species in slow or in rapid growth are much longer than those of *P. tremuloides*. They are often twice as long in stems which have made the same amount of growth. Fig. 2, *a b c*, illustrates the buds and leaf scars on young stems of *P. grandidentata*.

Populus monilifera.—The pith is light-brown and a cross section is usually pentagonal. In most slender young branches the pith is green, changing to brown on an exposure of a few minutes to the air. The shape of the leaf scars is about midway between that of *P. tremuloides* and *P. grandidentata*. Branches which have made slow growth and the base of thrifty branches are often without angles on the surface. Thrifty young branches have from five to eight prominent vertical ridges. One of these ridges extends below the center of a bud and one runs down from either side of the leaf scar. The branches are of a yellowish or greenish-brown color. There are a few round or oval white or brown spots on thrifty stems a year old. The buds are brown, viscid, not very glossy, and are destitute of pubescence, except a little on the margins of bud scales. The buds are larger but their shape is much the same as those of *P. tremuloides*. On thrifty branches there are often some buds mixed in with those larger which are short and not fully developed. For illustrations see Fig. 3, *a b c d*.

Populus balsamifera.—The young branches are brown and polished. The lower buds of the season are broad and small, and the scar below is broad. The lower buds and leaf scars of these four species of Populus are much alike in shape. The buds on the middle of the thrifty growth of *P. balsamifera* are quite long, often seven-eighths of an inch. They are curved and pointed, and become viscid. Fig. 4, *a b c d e*, illustrate buds and leaf scars of this species.

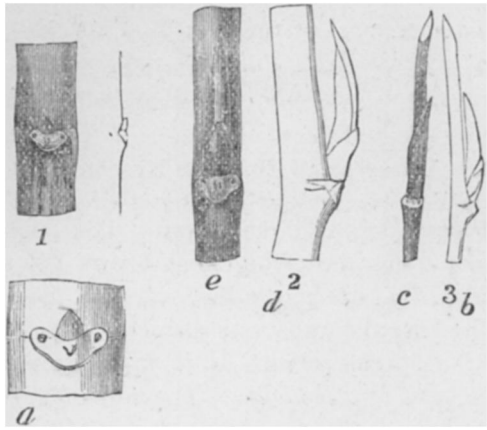

FIG. 4.

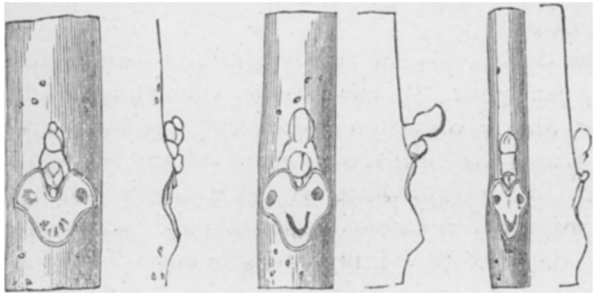

FIG. 5.

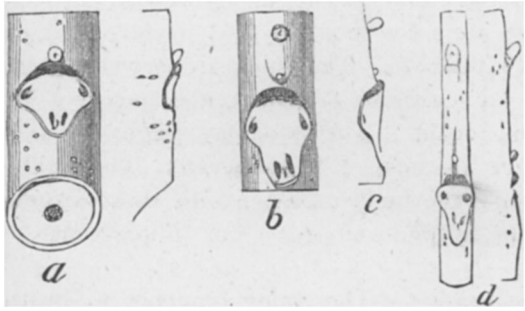

FIG. 6.

EXPLANATION OF THE FIGURES.

FIG. 4.—*Populus balsamifera.* *a*, enlarged view of stem near the lower end; *b c*, views of middle of a very slender stem; *d e*, views of middle of a large growth of a thrifty stem.

FIG. 5.—*Juglans nigra.* A front and side view of thrifty growth near the base; *b c*, a similar view from a thrifty branch near the middle; *d*, similar views of a slender stem near the middle or top.

FIG. 6.—*Juglans cinerea.* *a*, two views of a stem near the base; *b c*, similar views near the middle of a branch, *d*, similar views of slender stems.

Juglans nigra.—The pith of this species consists of thin plates running transversely, leaving open cavities between them. The pith is of a light-brown color. On a thrifty branch the bud scar is nearly heart-shaped with vertical and transverse diameters about equal. A very small bud can be seen in the sinus of the scar. Above this is a larger bud, most of which is also within the sinus of the leaf scar. Above these buds is a third one, still larger. The transverse diameter of the leaf scar is about equal in length to the distance between the leaf scar and the tip of the upper bud. A side view of the leaf scar shows quite a sharp depression in the middle. On slender branches the bud scars are laterally compressed or appear longer than on stout branches. Fig. 5, *a b c d*, illustrate this species.

Juglans cinerea.—The pith is separated in plates. It is of a dark brown color and in a narrower cavity than that of *J. nigra.* The leaf scar on a thrifty growth is not unlike the shape of a sheep's face. The scars left by the woody bundles of the leaf are shown in the drawings of all the species above mentioned. Towards the lower part of a branch, one bud only appears above the leaf scar; farther up on thrifty branches two buds may be seen. The scar is without any sinus or depression at the top. In this species, on the middle of rapid growth, the upper bud is from one-fourth to two-thirds of an inch or even more above the top of the leaf scar. Along the top of the leaf scar is a transverse or curved ridge or crest resembling velvet or plush. This crest is not present in *J. nigra*, but is rarely if ever absent in *J. cinerea.* The bark on a thrifty branch of *J. nigra* when one year old is about a third thicker than that on branches of *J. cinerea* of the same age and size. After the first year, and sometimes sooner, the outer bark of *J. nigra* cracks and rolls up in scrolls, while the outer bark of *J. cinerea* shows nothing of the kind. Fig. 6, *a b c d*, illustrates this species.

The young trees of these two species of Juglans are not easily distinguished by the leaves. In the axil of the leaf of *J. cinerea*, even when quite young, can be seen the velvet ridge. The odors of crushed leaves of the two species are different.

Some observations lead me to believe that many other trees and shrubs can be equally well distinguished by the young naked branches, while in some cases it will be difficult to find good specific characteristics. The drawings for this paper were made by W. Holdsworth.